



**XXV. International Balkan and Near Eastern Congress Series on  
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**March 14-15, 2026**

University of Agribusiness and Rural Development/Bulgaria  
University "St. Kliment Ohridski" Faculty of Economics/Republic of North Macedonia  
University "Isa Boletini"- Mitrovica, Faculty of Economics / Republic of Kosovo  
IBANESS

# **PROCEEDINGS**

**Editors**

**Prof.Dr. Mariana IVANOVA**

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**Prof.Dr. Rasim YILMAZ**

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## FOREWORD

International Balkan and Near Eastern Congress Series brings together many distinguished social and behavioral science researchers from all over the world. Participants find opportunities for presenting new research, exchanging information, and discussing current issues.

We are delighted and honored to host the IBANESS Congress Series in Plovdiv / Bulgaria. Presented papers have been selected from submitted papers by the referees. Sincere thanks to those all who have submitted papers.

We hope that through exchange of the presented researches and experiences, the Congress will enhance communication and dissemination of knowledge in Balkan and Near Eastern Countries.

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## Circular Economy and Packaging Glass: Practices and Challenges in the Republic of North Macedonia

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**Abstract:** According to projections from the Ministry of Environment and Physical Planning of the Republic of North Macedonia, 116,028.70 tons of packaging waste were released onto the market in 2025. It is assumed that almost one sixth of that amount is glass. The main focus of the paper is on the management of glass packaging within the context of the circular economy in the Republic of North Macedonia.

Through an analysis of existing collection, sorting and recycling practices, the main challenges and opportunities for improving the efficiency of packaging glass waste management systems will be identified. The issue is becoming particularly relevant because it has not been seriously addressed by scientific research so far, national targets for glass packaging waste collection are increasing, and costs for producers and importers are rising each year. Along with aluminum, glass is the fraction whose management requires the most resources.

The authors will study the current setup of the system for collecting this fraction of packaging waste through the method of analysis. The paper will provide a clear picture of the channels for collecting packaging glass in the Republic of North Macedonia, of which the HoReCa facilities and the infrastructure located in public areas have a dominant place. The authors will also identify the main shortcomings in the current system and point out the main problems to which all efforts should be directed in the future. According to comparative experiences from European Union countries, the authors will also propose appropriate activities aimed at improving the functioning of the system, with the objective of establishing sustainable strategies that will contribute to the circularity of glass packaging and the achievement of legally defined national targets.

**Keywords:** waste management, packaging glass, recycling, HoReCa.

### 1. INTRODUCTION

Glass is one of the oldest known materials used for product packaging, with a history spanning three millennia. This is evidenced by numerous archaeological findings of glass vessels in well-known ancient sites such as Heraclea and Stobi. During that period, the use of this type of packaging was characteristic only of the wealthiest social classes. Civilization would witness its mass production many centuries later. In the 20th century, the first automatic bottle-blowing production lines were developed, producing bottles uniform in height, weight, and volume. The mechanisation of the bottle glass production that took place at the beginning of the 20th century saw far-reaching changes to the industry. While mechanisation allowed an increase in the production of bottles, it is also possible to view mechanisation as a strategy employed by capitalists to de-skill and depower their workforce (Dungworth, 2012). Glass packaging, which had previously been expensive, became highly popular and widely accessible.

Glass is one of the few materials that can be recycled an unlimited number of times without any loss of quality. It is an inorganic substance and a biologically inert material that today is almost indispensable in everyday use. However, the production of glass packaging, especially from primary raw materials, requires high energy consumption. Therefore, one of the most effective ways to reduce the use of energy and natural resources is the application of circular economy principles — specifically, basing new glass packaging on the highest possible proportion of recycled material derived from waste glass packaging (German cooperation, Sekopak, 2022). The advantages of glass used in food packaging are numerous. It is a strong, durable, and chemically inert material; it does not interact with food, does not react with chemicals, and does not corrode. It does not require additional special coatings and has a shiny, smooth structure. Since its raw materials are abundant in nature, glass is both reusable and recyclable. The negative characteristics include the fact that glass packaging generates up to three times more air pollution than plastic packaging, is costly to transport over long distances, and is expensive for manufacturers. Its production also requires higher energy consumption compared to other packaging materials. In addition, glass is heavy and may create challenges in transportation (YARIS & CEYHUN SEZGIN, 2017).

Analyses conducted in Europe across 20 countries confirm that glass recycling represents a highly traceable value chain in which post-consumer municipal waste becomes a high-quality input material for the production of new glass bottles and jars. As much as 87% of the total reported tonnage entering glass cullet recycling facilities originated from municipal waste streams. In 2022, 93% of the total reported tonnage entering these facilities was effectively recycled, while 97% of the effectively recycled tonnage was reintegrated directly into glass manufacturing processes (Close the glass loop, 2025). The more glass packaging is collected through a high-quality separate collection system, such as a DRS, the more glass is likely going to flow back into the manufacture of new single-use glass. To retain material in a closed-loop, an efficient refillable system with optimised transport distances and high number of refill cycles could also offer a potential solution as an alternative to single-use glass (Zero waste Europe & Eunomia, 2022).

The European Commission, in its latest report on the Republic of North Macedonia under Chapter 27: Environment and Climate Change, assesses waste management in the country as an area facing numerous challenges. The implementation of the circular economy is stagnating. The main challenges include limited awareness and knowledge among stakeholders, insufficient financial resources, and infrastructure constraints. The Extended Producers Scheme (EPR) has not yielded the anticipated improvements and continues to face a range of persistent challenges. The number of producers responsibility organisations (PROs) continues to increase, but without sufficient supervision it may seriously jeopardise market functioning and undermine achievement of the national targets (COMMISSION STAFF WORKING DOCUMENT, 2025).

The entities placing the largest quantities of non-returnable glass packaging on the market in North Macedonia are wineries, bottled-water producers, and breweries (bottles), as well as parts of the food industry (jars). Building an efficient system for managing glass packaging waste is a costly and complex process. Increasing national targets, pressure to establish a more effective circular system for this waste fraction, and the growing need for corporate social responsibility to become an integral part of business strategies of Macedonian companies (Gjorgjioska, Gligorovski & Obednikovska, 2024) all provide strong justification for a detailed analysis of the current conditions and weaknesses of the national system.

Producers are subject to increasingly strict oversight, and transparent operations are expected from them (Gjorgjioska, Janeska, Spaseska, Boshkoska & Gligorovski, 2025). Waste management is being elevated to a higher level of importance. The question of who will be entrusted with managing glass packaging waste is no longer purely financial; it has also become an issue that strongly affects corporate reputation. Obligations related to waste management are increasingly aligned with the protection of fundamental freedoms and are therefore becoming part of ESG considerations that will continue to be the subject of analysis in the future (Gjorgjioska, Janeska, Spaseska, & Risteska Jankuloska, 2025).

## 2. MANAGEMENT OF GLASS PACKAGING WASTE IN THE REPUBLIC OF NORTH MACEDONIA

According to the annual reports submitted to the Ministry of Environment and Physical Planning by the collective operators and some small producers for 2024, of the total packaging waste placed on the market in 2024 (80,575.87 tons), paper and cardboard accounted for the largest share. Plastic ranked second with 29%, followed by other types of packaging, including glass at 17% and wood at 11%. At the bottom of the table were composite materials and metals (Ministry of Environment and Physical Planning Republic of North Macedonia, 2024).

The management of glass packaging waste has a relatively short history in Republic of North Macedonia. Initial results have been modest. In 2011, according to the Ministry’s Annual Report, only 29.00 tons of glass were collected (Ministry of Environment and Physical Planning Republic of Macedonia, 2013). By 2013, 1,525.48 tons of glass packaging waste had been collected, representing 14.68% of the total quantities placed on the market.

Table 1. Preview of the glass packaging waste placed, collected and recycled in North Macedonia in the period 2020-2024

Year	Quantity Placed on the Market (tons)	Glass Collected (tons)	Material Recycled (tons)	Material Recycling Rate (%)
2020	11577,78	3781,96	3781,96	32,67
2021	12652,92	6180,47	6180,47	48,85
2022	13171,59	6205,69	6205,69	47,11

2023	13415,86	6845,43	6845,43	51,02
2024	13854,93	7570,76	7570,76	54,65

Source: Reports of Ministry of Environment and Physical Planning Republic of North Macedonia, 2020-2024.

In 2024, of the 13,854.93 tons of glass packaging placed on the market, as much as 11,724.51 tons were managed through the collective compliance scheme Pakomak LLC Skopje, the first collective waste management operator in the Republic of North Macedonia. Therefore, an analysis of the operations of Pakomak LLC Skopje, the first and most significant collective waste management operator, can provide the most relevant picture of glass packaging waste management in the country.

This situation is due to the fact that Pakomak LLC Skopje’s clients, numbering 809 as of December 31, 2024, include the largest producers and importers of products in glass packaging, primarily beverage producers such as Tikveš AD Kavadarci, Pivara Skopje AD, Prilepska Pivarnica AD Prilep, and others. Glass packaging waste accounts for 21.7% of the total packaging waste generated by Pakomak’s clients (PAKOMAK, 2025). The total quantity of collected and exported glass packaging managed through this operator in 2024 was 6,172.84 tons, achieving the specific national target of 52%, corresponding to a recycling rate of 52.65%.

As shown by the data above, the overall recycling rate meets the legally defined targets. However, it should be noted that these targets are set to increase significantly: by December 31, 2030, the recycling rate is expected to reach 70%, and by December 31, 2035, it is projected to rise to 75% of the total weight of glass packaging placed on the market (Law on Packaging and Packaging Waste Management).

The fact that managing this waste fraction is a challenging process is also confirmed by examples from several European Union countries. For instance, in Romania, glass packaging waste had an average recycling rate of 49.48%, with significant variations over the years: 34.66% in 2008, reaching a maximum of 66.26% in 2012, followed by a decline and a return to 64.1% in 2016. After that, the decreasing trend continued, reaching 30.02% in 2022. (BĂLĂNICĂ DRAGOMIR, et al. 2025).

### 3. INFRASTRUCTURE OVERVIEW AND SOURCES OF GLASS WASTE

Glass waste is typically the least profitable waste fraction, which explains why, prior to the establishment of national targets and the introduction of the Extended Producer Responsibility system, there was no organized collection system. Recognizing that a large share of glass packaging is generated in the HoReCa sector (hotels, restaurants, and cafés), Pakomak LLC Skopje began developing a collection network in the HoReCa sector. In 2014, glass packaging was collected from only 22 HoReCa establishments in Skopje. The network has continuously expanded, with a justified pause during the pandemic. By 2024, the network covers 1,340 active locations, including 588 in Skopje and 752 elsewhere in the country.

The total quantity of glass packaging waste collected from the HoReCa system nationwide in 2024 amounted to 4,137.273 tons, representing 67% of the total collected glass. Comparative experiences show that the HoReCa sector’s contribution varies across countries: 27% in Ireland, 22% in the United Kingdom, 20% in Norway, and 9% in the Netherlands. In other countries, glass from the HoReCa sector is collected together with municipal waste (Close the glass loop, 2025). Collection from establishments is carried out using 120-liter plastic bins owned by Pakomak LLC Skopje, transported via vans or pickup vehicles. The practice of using specialized companies for collection from HoReCa establishments has proven most effective, as rapid response is needed due to limited storage space in the establishments, which are often located in central and tourist-heavy areas where maneuvering large municipal vehicles is challenging (German cooperation, SEKOPAK, 2022).

Across 44 municipalities, “igloo” containers have been installed for collecting glass packaging. In total, 1,123 specialized igloo containers, owned by Pakomak LLC Skopje, are placed in public areas. By the end of 2024, 1,256.48 tons of glass packaging waste were collected from public spaces, representing 20.35% of the total collected glass for the year. Location selection for the containers considers population density, traffic flow, and similar factors (German cooperation, SEKOPAK, 2022). Experience has shown that igloo containers should not be placed in isolated locations to prevent contamination with other waste fractions. Effective management of glass collection from public areas requires active cooperation between municipal authorities and collective waste operators (Mateski, Gjorgjioska & Bundaleska 2021).

A third collection channel is the “door-to-door” service, which in 2024 collected 200.9 tons of so-called historic glass packaging. Additionally, 500 tons of glass were collected directly from producers, mostly as production scraps or during changes in returnable packaging.

Pakomak LLC Skopje works with 18 partner companies that carry out collection, sorting, and transport of glass packaging. The final holder of this glass waste is the facility of Unitrade ECO LLC Sofia. Collaboration with municipal utilities is generally poor, mainly due to weak operational and technical capacity, low professionalism, political interference, and lack of interest in fulfilling obligations under the Waste Management and Packaging Waste legislation. Collection is outsourced except in Skopje, where public collection from public spaces is handled by the municipal utility.

A major challenge in the country is the lack of serious existing capacities for glass recycling, which creates an objective difficulty for initial glass processing. This drives up costs, as recycling solutions must often rely on exporting the glass to neighboring countries. The only entity that recycles waste glass into repro-material for the production of composite materials used in interior solutions is Akron, which has a very limited production capacity (OECD, 2024).

In 2024, Pakomak, in collaboration with the Swiss Embassy in the Republic of North Macedonia, for the first time began installing an electronic monitoring system to track the fill levels of igloo containers, along with issuing dedicated collection orders for their emptying as part of the Smart Packaging Waste Management Project. This system provides Pakomak with real-time visibility of the equipment’s status across the country. Such complete oversight enables detailed planning, regrouping, and rotation of the existing igloo containers, as well as identifying the need for new containers to ensure adequate coverage in different regions. Vehicles are equipped with electronic devices displaying precise daily collection routes for servicing the igloo containers (PAKOMAK, 2025). This represents a successful example of an internationally funded project in North Macedonia. Similar waste management initiatives are the Regional Solid Waste Project with the European Bank for Reconstruction and Development (2022), and the EU-supported “Support in the Implementation of Waste Management Legislation and Extended Producer Responsibility Scheme” project (2022–2024), funded through IPA 2014–2020, among others (OECD, 2024).

To reduce transport costs, which can be exceptionally high, the construction of eight glass collection centers is planned. These centers will allow the reduction of glass packaging volume prior to organizing transport for export. Experience shows that the only feasible method for glass packaging volume reduction is crushing, which achieves approximately a 65% reduction in packaging volume (Aydın. S., Güneysu. et. all 2025).

It should also be noted that the quantities of glass collected on behalf of Pakomak’s clients in 2024, as reported in the latest Annual Report to the Ministry of Environment and Physical Planning, show monthly stability with relatively small fluctuations. Monthly volumes ranged from 435 to 666 tons (PAKOMAK, 2025). One likely reason for this pattern is seasonal consumption: wine packaged in non-returnable glass is mostly consumed in winter, while water, beer, and other beverages are consumed during warmer months. Other influencing factors include the frequency of emptying igloo containers and the collection of production glass waste, particularly when packaging changes force manufacturers to generate scrap glass.

#### **4. RAISING PUBLIC AWARENESS FOR GLASS PACKAGING SEPARATION AND SERVICE FEES**

In its latest report, the Ministry of Environment and Physical Planning noted that the number of producers complying with the legal obligation to report has increased, given that many producers delegate their responsibility to a legal entity for packaging waste management (a collective waste management operator). However, to fully meet the obligations, further efforts are needed to raise public awareness, ensure active participation of municipalities and producers in the packaging waste management process, and strengthen the role of inspections in supervising the implementation of the Packaging and Packaging Waste Management Law (Ministry of Environment and Physical Planning Republic of North Macedonia, 2024).

In 2024, the collective operator Pakomak LLC Skopje allocated 8,868,995 MKD (approximately €144,000) to public awareness campaigns, representing 8.75% of revenues from fees. According to the Law on Extended Producer Responsibility for managing specific waste streams, a collective operator is required to spend at least 5% but no more than 15% of the total revenue from the previous year on activities to inform the public and raise awareness about managing specific waste streams. These activities aim to encourage interest in waste management, separate collection, and recycling of specific waste streams to achieve higher compliance with national targets (Law on Extended Producer Responsibility for the Management of Special Waste Streams). This legal framework

was established to ensure that collective operators direct the majority of costs toward infrastructure investment, as well as collection, transport, processing, recycling, and disposal of waste products and/or specific waste streams under their management. For illustration, these operational costs account for as much as 78% of Pakomak LLC Skopje's total expenditures.

Despite the fact that some HoReCa entities demonstrate high environmental awareness, a significant portion still resists, treating waste separation as an unnecessary activity that consumes time and space—even though bins for glass packaging waste are provided free of charge, and collection is also free, without any financial burden on the HoReCa sector. Authorized municipal environmental inspectors are obliged to ensure that end users of packaging waste collect or store it separately to prevent mixing, destruction, or pollution (Law on Packaging and Packaging Waste Management).

Pressure on the HoReCa sector to comply with waste separation obligations must operate in two directions. First, through education and, when necessary, enforcement by the competent inspectors with strengthened oversight of waste separation; second, by raising public awareness so that consumers, through continuous education, increasingly value and prefer HoReCa establishments that implement higher environmental standards in their services. Naturally, the first direction is expected to produce more visible and faster results.

An interesting finding from a survey conducted in February 2019 with 1,200 respondents shows that 58% of consumers consider waste separation to positively influence their choice of entertainment or dining venues. This indicates that hotels, cafés, and restaurants that separate the waste generated during their operations can also leverage this as a marketing advantage to retain and expand their clientele. Pioneering steps in this direction were taken by Pakomak LLC Skopje through the certification of hotels, restaurants, and cafés with eco-brands: Pakomak Eco Café, Pakomak Eco Restaurant, and Pakomak Eco Zone. To qualify for these certifications, an establishment must operate in the HoReCa sector (restaurant, café, etc.), generate packaging waste from non-returnable glass and/or PET plastic packaging, have a cooperation agreement with Pakomak LLC Skopje as the collective packaging waste operator, and fully comply with the agreed services and applicable legal and regulatory requirements for packaging waste management (Mateski, Gjorgjioska 2021). For establishments larger than 200 m<sup>2</sup>, a dedicated space for selective waste collection is required (PAKOMAK Rules for the use of a certification trademark). The eco-certification brands of Pakomak LLC Skopje—Pakomak Eco Restaurant, Pakomak Eco Zone, and Pakomak Eco Café—demonstrate strong interest from the HoReCa sector in North Macedonia (Gjorgjioska & Mateski 2022). In 2018, 607 restaurants, hotels, and cafés were certified, and by 2025, this number has nearly doubled. These establishments are easily recognizable, as the branding quickly became widely known.

The HoReCa sector faces typical challenges common across the region, such as high staff turnover and a limited focus on waste management. One of the tools to ensure transparent operations is the provision of electronically issued identification and transport forms for each HoReCa establishment every time glass packaging is handed over. This approach ensures documentary traceability of compliance with packaging waste management obligations, allows a central overview of glass packaging waste quantities per establishment, and increases pressure on entities that demonstrate poor performance to comply with legal requirements.

Unfortunately, existing oversight of HoReCa establishments often only verifies whether a contract for glass packaging waste management has been signed, without further checks on the quantities delivered. This issue, partly due to inspector training gaps and the ease of circulation of forms, needs to be significantly addressed.

One approach for bilateral cooperation between Pakomak LLC Skopje and HoReCa entities is the “green points” system, whereby points earned from return vending machines can also be used in HoReCa establishments to pay for services.

Despite the high costs of exporting glass packaging waste, challenges in cooperation with municipalities, and substantial investments required for collecting glass waste from the HoReCa sector, a comparative analysis of the fees paid by producers and importers of glass packaging confirms that Pakomak LLC Skopje charges the lowest fees. At the same time, through well-established infrastructure and effective public awareness campaigns, it successfully achieves national targets.

Table 2. Fees for glass waste management in North Macedonia, Serbia, Bulgaria and Romania in 2025

<b>Comparison of Fees for Glass Waste Management for 2025 (€/ton)</b>			
<b>Pakomak (North Macedonia)</b>	<b>Serbia</b>	<b>Bulgaria</b>	<b>Romania</b>
47,5	107	94	95

Source: Decisions on fee rates adopted by collective packaging waste management schemes in the countries of the region

With the increase of national targets and the expected rise in costs for maintaining and expanding the system, the fee for assuming glass waste management obligations for clients of Pakomak LLC Skopje in 2026 has been raised to €56 per ton (Decision on fees for 2026, No. 02-7986). The actual costs of managing glass packaging waste—which include collection, infrastructure, public awareness campaigns, operational expenses, and similar activities—are higher. However, according to business policy, these costs are covered through continuous cross-subsidization from fees collected from other waste fractions, a practice common among nearly all collective waste operators in Europe.

Unfortunately, a strong indicator that environmental protection is a low priority among producers and importers is the fact that an estimated 48% of them are unregistered entities under the Packaging and Packaging Waste Law and do not pay any fees for packaging waste management (Ministry of Environment and Physical Planning, 2022). Further in-depth analyses are needed regarding consumer awareness—similar to studies conducted for plastic packaging (Angeloska-Dichovska et al, 2023)—as well as on factors contributing to the reduction of certain waste types (Gjorgjioska, et. all 2023), in order to define the most effective methods for raising public awareness among consumers.

## 5. CONCLUSION

The Republic of North Macedonia successfully meets the established national targets for the management of glass packaging waste. The infrastructure is almost entirely an exclusive investment of the collective operator Pakomak LLC Skopje. One of the main problems that significantly affects costs is of an objective nature — namely, the absence of a recycling facility within the country, which results in export costs representing a substantial share of total expenses. The situation is further negatively affected by the fact that glass has exceptionally low commercial value.

Further efforts are needed to define the most efficient routes for collecting glass waste, for which positive effects are expected from the introduction of smart fill-level monitoring systems for igloo containers and the establishment of collection centers across the country. The system for collecting glass packaging from HoReCa facilities is well established and should continue to be further upgraded. More detailed studies are needed to assess the untapped potential for collecting this type of waste from the HoReCa segment. The introduction of electronic transport and identification forms could significantly improve discipline and control in managing this waste stream.

The management of this waste fraction from public areas must also be improved. The main challenge faced by collective compliance schemes is the weak political will and lack of engagement from municipalities and public utility companies. Efforts should also focus on strengthening cooperation capacity with international donors, which would positively contribute to expanding and modernizing infrastructure.

The achievement of increasingly ambitious national targets is expected to create additional pressure on the fees paid by producers and importers placing products in glass packaging on the market. Nevertheless, current fees remain competitive compared to those in other European and regional countries. Encouraging the use of returnable glass packaging should be pursued at the national level.

There is a lack of systematic control over all stakeholders in the value chain; therefore, it would be beneficial to continue discussions on the future development of a dedicated control body for packaging and packaging waste, involving representatives from the competent ministry, collective compliance schemes, and producers. One possible measure to reduce the landfilling of mixed waste is to increase landfill fees in order to stimulate recycling, while carefully ensuring that such a policy does not further worsen the problem of illegal dumping.

Raising public awareness must continue at an intensified pace. Primary waste separation should be supported through media, educational institutions, civil society organizations, and similar channels.

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